

# NASA TECH BRIEF



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## Miniaturized High-Resolution Mass/Charge Spectrograph: Design Study

A comprehensive study was carried out to determine the optimal parameters for the design of a double-focusing spectrograph that could be used for measuring mass/charge composition of the solar wind. Basic design considerations were to make available in miniature size the high-resolution capability of conventional, large mass/charge spectrographs. Although the design principles of such spectrographs generally apply to the design of a miniaturized instrument, no previously available instrument could perform the specific measurements on the solar wind.

The study showed that it would be feasible to design a double-focusing mass/charge spectrograph (including electronic components) weighing less than 25 pounds. The instrument would have a theoretical resolution exceeding 2000 with a 0.001-inch object slit. The solar wind input could be replaced with a built-in ion source, which is normally used in mass/charge spectrographs. In such an instance, features which pertain to the use of the instrument as a solar wind probe could be eliminated without destroying the novel feature of the proposed instrument, besides its small size; namely, the use of a parallel-plate energy filter between the ion source and the double-focusing units (electric and magnetic sectors). This feature avoids the difficult problem of designing an ion source of small energy spread which is common to available mass/charge spectrographs.

Mass/charge in the range 2 to 10 could be accepted by the instrument using one permanent magnet. This would be accomplished using an accelerator unit and a decelerator unit which together would provide the

means of selecting a given mass/charge number. A velocity deviation of  $\pm 0.20$  could be accepted by the instrument. However, a velocity deviation of only  $\pm 0.10$  would be necessary to display a mass/charge deviation of  $\pm 0.20$  over a 1-inch segment of photographic plate. A high-voltage supply of approximately 12 kilovolts with at least 1 percent of regulation would be required. Mass/charge and solar-wind-velocity tuning would be accomplished by interdependently varying the potentials across several high-voltage elements in the instrument.

### Note:

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Reference: NASA CR-92438 (N69-14669),  
Feasibility Study for Double-Focusing  
Mass Spectrograph

### Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

Source: L. H. Taylor of  
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# NASA TECH BRIEF

This brief describes the results of a study conducted by the NASA Langley Research Center, Hampton, Virginia 23151, in cooperation with the U.S. Space Program.

## Photometric High-Speed Photography Design Study

A study was conducted to determine the feasibility of using a high-speed photometric camera to measure the velocity of a projectile in a vacuum chamber. The camera was designed to operate at a frame rate of 10,000 frames per second. The camera was mounted on a rotating platform to allow it to follow the motion of the projectile. The camera was triggered by a signal from a photodiode which was mounted on the projectile. The camera was used to measure the velocity of a projectile in a vacuum chamber. The results of the study are presented in this brief.

The camera was designed to operate at a frame rate of 10,000 frames per second. The camera was mounted on a rotating platform to allow it to follow the motion of the projectile. The camera was triggered by a signal from a photodiode which was mounted on the projectile. The camera was used to measure the velocity of a projectile in a vacuum chamber. The results of the study are presented in this brief.

The camera was designed to operate at a frame rate of 10,000 frames per second. The camera was mounted on a rotating platform to allow it to follow the motion of the projectile. The camera was triggered by a signal from a photodiode which was mounted on the projectile. The camera was used to measure the velocity of a projectile in a vacuum chamber. The results of the study are presented in this brief.

The camera was designed to operate at a frame rate of 10,000 frames per second. The camera was mounted on a rotating platform to allow it to follow the motion of the projectile. The camera was triggered by a signal from a photodiode which was mounted on the projectile. The camera was used to measure the velocity of a projectile in a vacuum chamber. The results of the study are presented in this brief.

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The camera was designed to operate at a frame rate of 10,000 frames per second. The camera was mounted on a rotating platform to allow it to follow the motion of the projectile. The camera was triggered by a signal from a photodiode which was mounted on the projectile. The camera was used to measure the velocity of a projectile in a vacuum chamber. The results of the study are presented in this brief.